




# GS4

PROCESS CONTROL MODULE GS4

# User's Manual

# Safety Warnings



- This symbol  denotes an important safety tip or warning. Please read these instructions carefully before performing any of the procedures contained in this manual.
- **DO NOT INSTALL, REMOVE, OR REWIRE THIS EQUIPMENT WITH POWER APPLIED.** Have a qualified electrical technician install, adjust and service this equipment. Follow the National Electrical Code and all other applicable electrical and safety codes, including the provisions of the Occupational Safety and Health Act (OSHA), when installing equipment.
- Reduce the chance of an electrical fire, shock, or explosion by proper grounding, over-current protection, thermal protection, and enclosure. Follow sound maintenance procedures.



**WARNING**  
Circuit potentials are at 120 VAC or 240 VAC above earth ground. Avoid direct contact with the printed circuit board or with circuit elements to prevent the risk of serious injury or fatality. Use a non-metallic screwdriver for adjusting the calibration trimpots. Use approved personal protective equipment and insulated tools if working on this drive with power applied.

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# Specifications

## Power Requirements

**Line input** 120/240 VAC, 50/60 Hz, single phase

## Input Signal Ranges (input circuit is isolated)

Voltage signal  
     Narrow range -25 to +25 VDC  
     Wide range -250 to +250 VDC  
 Current signal 1–5 mADC, 4–20 mADC, 10–50 mADC

## Input Impedance

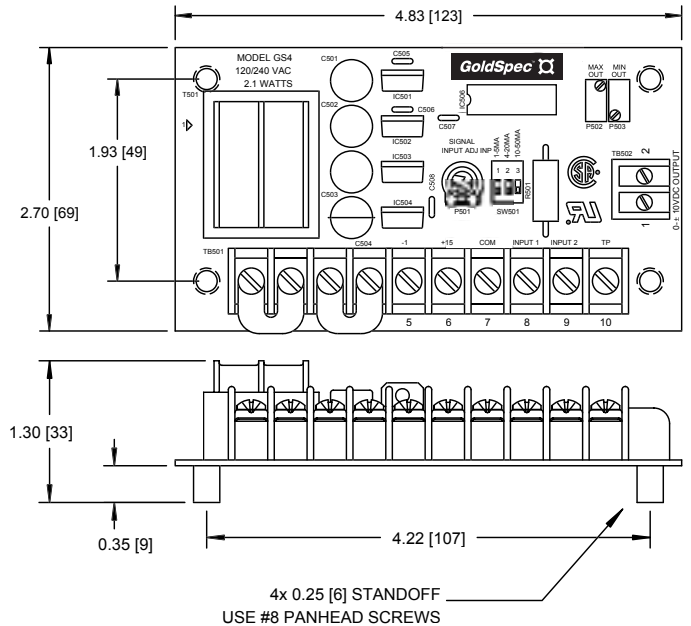
Voltage signal >25K ohms  
 Current signal  
     1–5 mADC 1K ohm  
     4–20 mADC 235 ohms  
     10–50 mADC 100 ohms

## Output

Impedance 800 ohms  
 Voltage range, max -10 to +10 VDC  
 Linearity 0.01%

**Operating Temperature Range 0 – 50 °C**

# Dimensions



**Figure 1. Process Control Module (GS4) Dimensions**

Model GS4 accepts a grounded or floating, bipolar, DC signal input and generates a proportional isolated output voltage. The output of the GS4 follows the variations of its input: it increases as the signal increases and decreases as the signal decreases.

This output can be supplied to the speed setting circuit of a motor drive to rotate the motor at a speed proportional to the signal input. Because the GS4 can follow bipolar input voltage signals, it can drive a regenerative variable speed drive through the complete range of motor speeds in both forward and reverse directions.

This manual contains specifications, installation procedures, connections, and calibration procedures for the process control module, model GS4. Refer to your variable speed drive user's manual for additional installation, operation, and troubleshooting procedures.

# Installation



## WARNING

Do not install, rewire, or remove this control with input power applied. Doing so may cause fire or serious injury. Make sure you have read and understood the Safety Warnings before attempting installation.

## Mounting

- GS4 components are sensitive to electrostatic fields. Avoid contact with the circuit board directly.
- Protect the GS4 from dirt, moisture, and accidental contact. Provide sufficient room for access to the terminal block.
- Mount the GS4 away from other heat sources. Operate within the specified ambient operating temperature range. The operating temperature range for the GS4 is 0°C through 50°C.
- Prevent loose connections by avoiding excessive vibration of the process control module board.
- Mount the GS4 in either a horizontal or vertical plane.
- The GS4 is mounted using 4 – 0.25 inch [6mm] standoffs. See Figure 1, page 3 for the physical locations of these standoffs. Use #8 panhead screws to fasten the standoffs to the mounting surface.

## Wiring



## WARNING

Do not install, remove, or rewire this equipment with power applied. Failure to heed this warning may result in fire, explosion, or serious injury.



Circuit potentials are at 120 or 240 VAC above ground. To prevent the risk of injury or fatality, avoid direct contact with the printed circuit board or with circuit elements.

- Use 18-24 AWG wire for signal wiring. Use 16-18 AWG wire for AC line (L1, L2) wiring.

## Shielding guidelines



## WARNING

Under no circumstances should power and logic leads be bundled together. Induced voltage can cause unpredictable behavior any electronic device.

As a general rule, manufacturer recommends shielding of all conductors.

If it is not practical to shield power conductors, manufacturer recommends shielding all logic-level leads. If shielding of logic level leads is not practical, the user should twist all logic leads with themselves to minimize induced noise.

It may be necessary to earth ground the shielded cable. Do not ground both ends of the shield.

If the drive continues to pick up noise after grounding the shield, it may be necessary to add AC line filtering devices, or to mount the drive in a less noisy environment.

Logic wires from other input devices, such as motion controllers and PLL velocity controllers, must be separated from power lines in the same manner as the logic I/O on the GS4.

## Screw terminal block

Connections to the GoldSpec™'s GS4 are made to a screw terminal block. Using a screwdriver, turn the terminal block screw counterclockwise to open the wire clamp. Insert stripped wire into the wire clamp. Turn the terminal block screw clockwise to clamp the wire. See Figure 2.

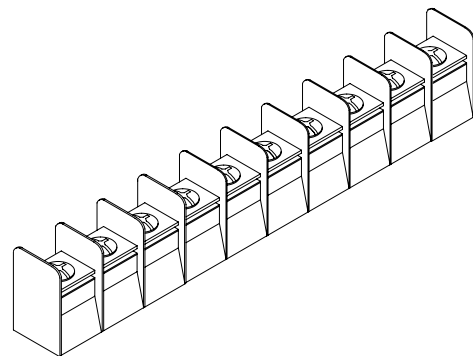


Figure 2. Screw Terminal Block

## Connections



### WARNING

Do not connect this equipment with power applied. Failure to heed this directive may result in fire or serious injury.

Manufacturer strongly recommends the installation of a master power switch in the voltage input line. The switch contacts should be rated at 2 amps AC and 250 volts

## AC line connections

When operating on 120 VAC, leave the jumper bars installed between terminals 1 and 2 and between 3 and 4 (see Figure 3). This is how the unit is shipped from the factory. When operating on 230VAC, remove both jumper bars and place one jumper bar between terminals 2 and 3 (see Figure 4).

Connect the AC power leads to terminals 1 and 4.

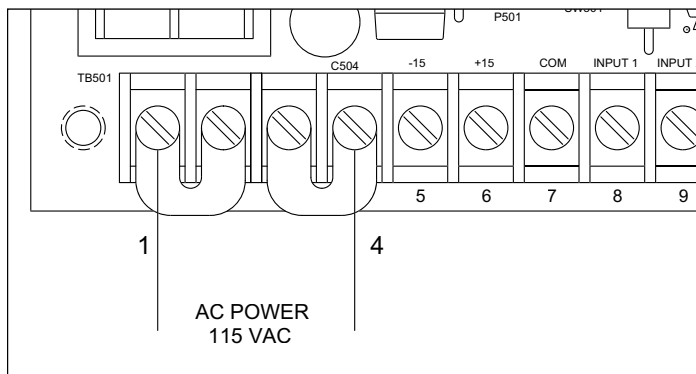


Figure 3. 115 VAC Power Connection

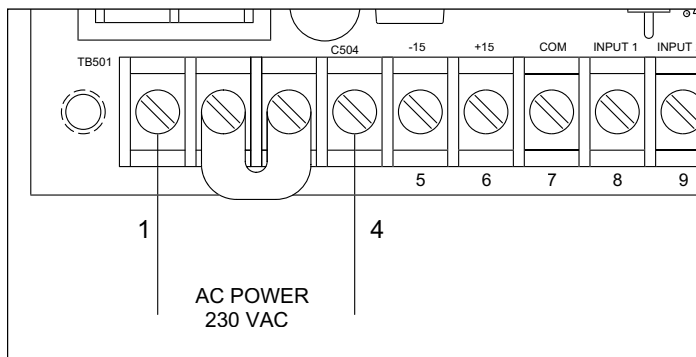


Figure 4. 230 VAC Power Connection

## Input signal connections

Connect the incoming voltage or current signal leads to INPUT 1 (terminal 8) and to COM (terminal 7). If the maximum input voltage will exceed 25V, connect the signal leads to INPUT 2 (terminal 9) and to COM (terminal 7). See Figure 5 below. Use insulated shielded wire or twisted pair for GS4 input and output signal leads longer than 18 inches. Connect the shielding to earth ground at the end away from the GS4 and trim the exposed shielding at the GS4 to preclude accidental grounding of the GS4.

Bundle the signal-carrying leads separately from the motor leads or AC power leads.

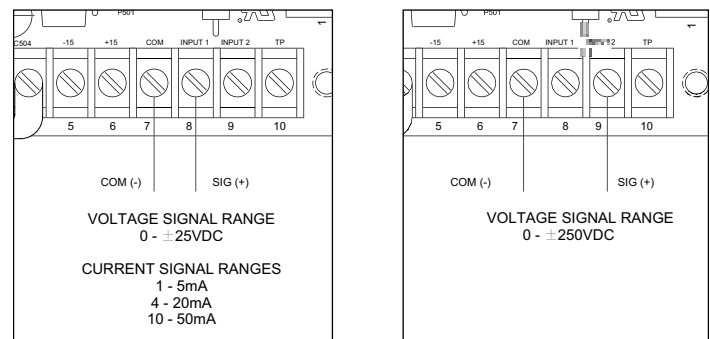


Figure 5. Connection – Following an External Signal

## Master signal generator



### WARNING

Bidirectional output mode should never be used with standard SCR (single quadrant) variable speed drives. These drives only respond to one polarity in their speed setting circuits.

The GS4 can be used as a master controller to:

- (1) provide a isolated DC master voltage input to other GS4 modules interfacing with standard variable speed drives or
- (2) to drive several variable speed drives directly, provided that their circuit design permits wiring of their speed circuits in common.

Unidirectional applications require a positive GS4 output. Connect a 10K ohm potentiometer (not provided with the GS4) as the master control pot using the +15 VDC supply on the GS4.

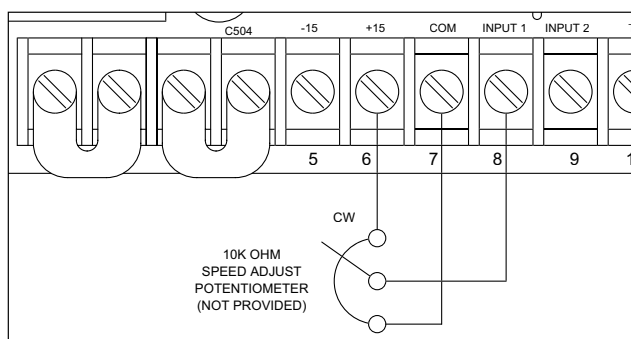
The normal wiring of an external master control potentiometer is the CW side of the potentiometer to +15 V supply (terminal 6), and the CCW side to COM (terminal 7). The potentiometer wiper is connected to INPUT 1 (terminal 8). See Figure 6 (page 6) . The potentiometer is rotated clockwise to increase the voltage at INPUT 1 and, therefore, increasing the GS4 output voltage.

# Installation (continued)

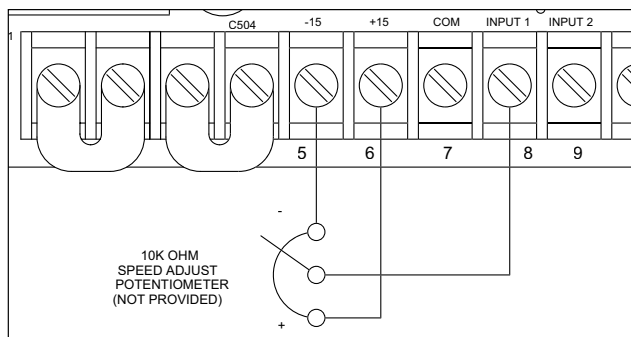
Bipolar input is necessary to control motor reversals when the motor is being driven by a four quadrant, regenerative variable speed drive.

To wire the external master control potentiometer to provide a bipolar, adjustable voltage input signal, wire the potentiometer across the -15 and +15V supply terminals, with the CW end at +15V. Connect the pot wiper to the INPUT 1 (terminal 8). See Figure 7 (page 6).

The center position of the wiper produces zero input voltage. Potentiometer rotation CW from center produces increasing positive voltage; CCW rotation from center produces increasing negative voltage.



**Figure 6. Unidirectional Manual Master Signal Source Connection**



**Figure 7. Bidirectional Manual Master Signal Source Connection**

## Output voltage connections



### WARNING

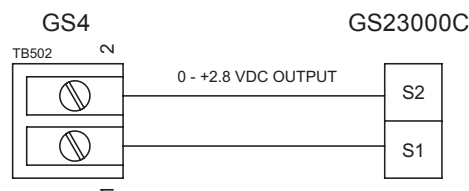
Always check the instruction manual supplied with the variable speed drive that will be interfaced with the GS4 module. The scheme shown for wiring to an external voltage source, as well as the specifications on that input, must be well understood before proceeding.

Output connections are made to the small terminal block on the board (TB502). Connect the output leads to terminal 1 and 2 (Figure 8). When the input signal at INPUT1 is positive with respect to COM terminal 2 will be positive.

The exception to this polarity rule occurs when the GS4 has been calibrated to bias its output as a voltage follower. An input of zero volts can be calibrated to produce a finite positive or negative output voltage.

The GS4 output is a isolated DC voltage. It is brought into the speed setting circuit of a variable speed drive to replace the main speed adjust potentiometer.

Most GoldSpec™ SCR-type, non-regenerative drives are designed with the speed setting voltage positive with respect to board common. The positive external signal is brought to the "speed pot wiper" terminal, usually designated S2, and the common signal lead to the "speed pot CCW" terminal usually S1.



**Figure 8. Connection – Output Voltage Installation 17**

## Multiple follower requirements



### WARNING

Most GoldSpec™ variable speed drives cannot be wired with their speed-setting circuits in common with each other. They require a dedicated GS4 for each variable speed drive.

Included are all GoldSpec™ models in the GS23000C series, and all regenerative drives (GS 60U series). A multiple follower system using any of these drives must consist of a master GS4 driving follower GS4 modules.

## Multiple drives following a single signal input

When more than one GoldSpec™ drive must follow one voltage signal, each must be wired individually to dedicated GS4 modules. Each GS4 module then receives the “master” input signal.

Each of the GS4 units must first be modified.

1. Check that all 3 DIP switches (SW501) , located near the center of the board, are in their OFF position.
2. Cut the left hand (CCW) pin of P501, the SIGNAL INPUT ADJ, off each GS4. The figure below shows this trimmer potentiometer.

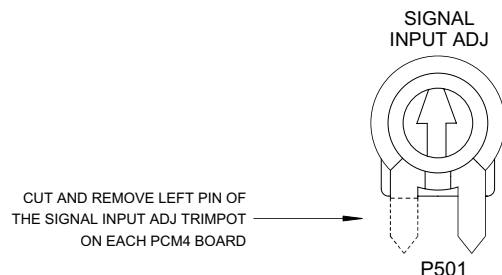


Figure 10. Signal Input Adjust

Connect one 50K ohm ratioing potentiometer across the master input voltage signal for each dedicated GS4 module. Wire each ratioing pot to the input signal source potentiometer as shown in Figure 11 below.

## Master GS4 with multiple drives following

If a GS4 is to provide the master input voltage signal as detailed on page 6, dedicated GS4's are again necessary. Each of the GS4's must be modified as detailed on page 19. Ratioing potentiometers may then be wired with their CW sides to terminal 2 of the master GS4 and their CCW sides to terminal 1 of the master GS4.

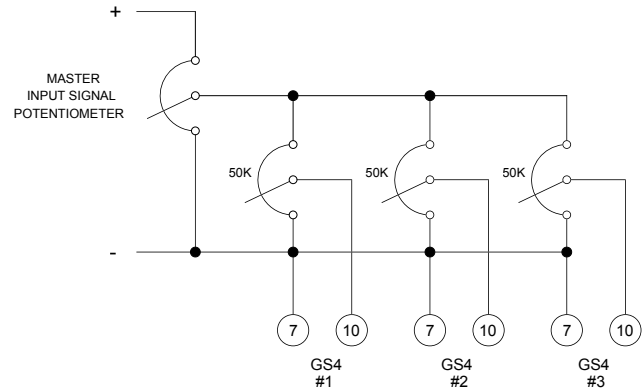


Figure 11. Connection – Ratio Potentiometers Multiple Follower System

## Calibration



### WARNING

Dangerous voltages exist on the GS4 when it is powered. If the trimpots must be adjusted with power applied, use insulated tools and the appropriate personal protection equipment. BE ALERT. High voltages can cause serious or fatal injury.

## Signal Input Adjust

The SIGNAL INPUT ADJ potentiometer is used to set the maximum Test Point voltage to approximately 5 VDC, as measured between terminals TP and COM. The importance of this step is to scale the input signal voltage to keep it well within the range of the GS4's comparator chip. This calibration is only approximate. A tolerance of 0.2 Volts is acceptable.

The SIGNAL INPUT ADJ is calibrated only when the GS4 is following a voltage signal. When the GS4 is following a current signal set the SIGNAL INPUT ADJ fully CW. See Figure 12 for approximate calibration of SIGNAL INPUT ADJ.

To calibrate the SIGNAL INPUT ADJ:

1. Apply the true maximum voltage input.
2. Check voltage at TP vs. COM to verify that it is approximately 5V. Adjust SIGNAL INPUT ADJ if needed.

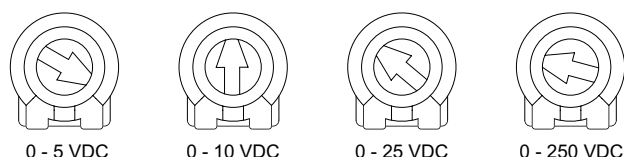


Figure 12. SIGNAL INPUT ADJ - Calibration Positions

## DIP switches



### WARNING

Only one DIP switch should be ON at a time and only when the GS4 is set up to follow a current signal. All three DIP switches must be OFF when following a voltage signal.

Each DIP switch selects the range for input current following. DIP switch 1 is for 1 – 5 mA input, DIP switch 2 is for 4 – 20 mA input, and DIP switch 3 is for 10 – 50 mA

input.

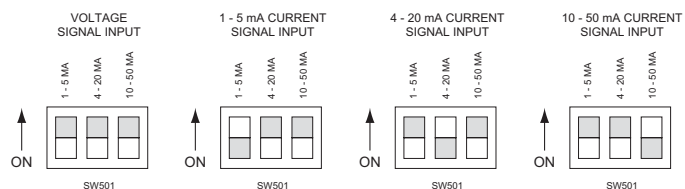


Figure 13. DIP Switch Settings

## Input signal calibration

Calibration of the MIN OUT and MAX OUT 15–turn trimpots is required to establish the relationship between the input voltage signal range and the output range.

The true maximum and minimum input signal values are not required. Because the GS4 response is linear, any two calibration points define the output vs. input relationship. Select points as close to the range extremes as possible to minimize extrapolation error.

The absolute maximum output from the GS4 is 10 VDC. The minimum input voltage to the GS4 that can produce 10 VDC output is 5 VDC.

## Input voltage calibration

To calibrate when using a voltage input signal:

1. Verify that all DIP switches are OFF.
2. Set the SIGNAL INPUT ADJ to the input range position, as indicated on Figure 12, page 8.
3. Apply the lower voltage input.
4. Set MIN OUT adjustment to obtain the desired lower



voltage output.

5. Apply the higher voltage input.
6. Set MAX out adjustment to obtain the desired higher voltage output.
7. Apply the true maximum input voltage.
8. Check voltage at TP vs. COM to ensure that it is approximately 5VDC at the maximum input voltage. Adjust SIGNAL INPUT ADJ if necessary.
9. Repeat steps 3 – 6 until no further recalibration is needed.

## Input current calibration

To calibrate when using a current input signal:

1. Verify that the correct DIP switch is ON and that the others are in the OFF position.
2. Set the SIGNAL INPUT ADJ fully CW.
3. Apply the lower current input.
4. Set MIN OUT adjustment to obtain the desired lower voltage output.
5. Apply the higher current input.
6. Set MAX OUT adjustment to obtain the desired higher voltage output.
7. Repeat steps 3 – 6 until no further recalibration is necessary.

## Troubleshooting



### WARNING

Dangerous voltages exist on the GS4 when it is powered. High voltages can cause serious or fatal injury.

### Before troubleshooting

1. Perform the following steps before starting any procedure in this section:

2. Disconnect AC line voltage from the GS4 and variable speed drive.
3. Check the GS4 and drive closely for damaged components.
4. Check that no conductive or other foreign material has become lodged on the printed circuit board.
5. Verify that every connection is correct and in good condition.
6. Verify that there are no short circuits or grounded connections.
7. Check that the input voltage jumpers are installed properly for the input voltage being used (see page 4).
8. Check that the drive's rated armature and field outputs are consistent with the motor ratings.

# Troubleshooting (continued)

Problem	Possible Causes	Suggested Solutions
Motor attached to the drive does not run.	1. No output voltage from GS4 (TB502).	1. Recalibrate the GS4. If there is still no output send GS4 to Applied® for repair.
	2. Loose connections between GS4 and motor drive.	2. Check connections between TB502 and the input of motor drive.
	3. GS4 is not receiving AC line voltage.	3. Apply AC line voltage to terminals 1 and 4.
	4. Input signal is not connected.	4. Check that the GS4 is receiving voltage (or current) input signal.
	5. SIGNAL INPUT ADJ potentiometer is not calibrated.	5. Calibrate SIGNAL INPUT ADJ (page 9)
	6. Motor drive not calibrated properly.	6. Re-calibrate motor drive according to manufacturer's instructions.

Problem	Possible Causes	Suggested Solutions
Motor is not running at full speed.	1. Voltage out (TB502) is not changing as input changes  2. Loose connections between GS4 and motor drive	1. Check that the voltage out (TB502) is changing as input changes. Recalibrate the GS4. If voltage is still not changing send the drive to Applied® repair.  2. Check connections between TB502 and the input of motor drive.
Motor runs too slow, or too fast.	1. DIP switches are not set properly for current input  2. Motor drive not properly working	1. Check DIP switch positions if using current input.  2. Re-calibrate motor according manufacturer's instruction





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